CLAIMS

1. An adhesive tape comprising:

a film substrate having one or more individual layers, wherein the film substrate has (i) an elastic modulus of at least 7.0 x 10^8 Pa at a temperature below an activation temperature, said activation temperature ranging from about 25°C to about 100°C, (ii) an elastic modulus of not greater than 5.0 x 10^8 Pa at a temperature exceeding said activation temperature, and (iii) an elongation at break of at least 150% at a temperature exceeding said activation temperature;

an adhesive layer disposed on at least one surface of the film substrate; and

a temperature-indicating material disposed within or on the film substrate, wherein the temperature-indicating material experiences a color change when exposed to a color-changing temperature.

2. The adhesive tape of claim 1, wherein at least one layer of the film substrate comprises an aliphatic polyester, polyvinyl chloride, polycarbonate, polycaprolactone, polyethylene terephthalate resin, glycol modified polyethylene terephthalate resin, polybutylene terephthalate resin, polyamide resin, polyvinylidene fluoride, one or more shape memory resins, or a combination thereof.

3. The adhesive tape of claim 1, wherein at least one layer of the film substrate comprises an aliphatic polyester, said aliphatic polyester comprising an aliphatic polyhydroxycarboxylic acid, an aliphatic polyester resin, or a mixture thereof.

4. The adhesive tape of claim 1, wherein the temperature-indicating material comprises a higher fatty acid ester; mercury iodide complexes of cholesterol; bianthrone; cyanine pigments; spirofuran-type compounds; triphenylmethane-type Ca and Mg salts; cobalt; nickel; iron; copper; chromium; manganese; lead; or a combination thereof.

5. The adhesive tape of claim 1, wherein said color-changing temperature is equal to or greater than the activation temperature.

6. The adhesive tape of claim 1, wherein said adhesive layer comprises an acrylic type or rubber type adhesive.

7. A method of removing the adhesive tape of claim 1 from a bonded article, said method comprising the steps of:

heating the adhesive tape to a temperature greater than the activation temperature; and

if the temperature-indicating material changes color, pulling the adhesive tape from the bonded article at an angle of up to 35° relative to a bonded surface on the bonded article.

8. An adhesive tape comprising:

a film substrate having (i) an elastic modulus of at least 7.0×10^8 Pa at a temperature below an activation temperature, said activation temperature ranging from about 25°C to about 100°C, (ii) an elastic modulus of not greater than 5.0×10^8 Pa at a temperature exceeding said activation temperature, and (iii) an elongation at break of at least 150% at a temperature exceeding said activation temperature, said film substrate comprising an aliphatic polyester, polyvinyl chloride, polycarbonate, polycaprolactone, polyethylene terephthalate resin, glycol modified polyethylene terephthalate resin, polybutylene terephthalate resin, polyamide resin, polyvinylidene fluoride, one or more shape memory resins, or a combination thereof; and

a first adhesive layer disposed on at least one surface of said film substrate.

9. The adhesive tape of claim 8, wherein said film substrate comprises an aliphatic polyester, said aliphatic polyester comprising an aliphatic polyhydroxycarboxylic acid, an aliphatic polyester resin, or a mixture thereof.

10. The adhesive tape of claim 8, wherein said film substrate comprises a polymer or copolymer formed from one or more hydroxycarboxylic acid monomers, said hydroxycarboxylic acid monomers comprising L-lactic acid, D-lactic acid, glycolic acid,

3-hydroxybutyric acid, 4-hydroxybutyric acid, 4-hydroxyvaleric acid, 5-hydroxyvaleric acid, 6-hydroxycaproic acid, or a combination thereof.

11. The adhesive tape of claim 8, wherein said film substrate comprises a polymer or copolymer formed from L-lactic acid, D-lactic acid, or a combination thereof.

12. The adhesive tape of claim 8, wherein said one or more shape memory resins comprise a polyisoprene type resin, a styrene-butadiene copolymer, a polynorbornane type resin, a polyurethane type resin, a fluorine-containing resin, ε-polycaprolactone, a polyamide resin, or a combination thereof.

13. The adhesive tape of claim 8, further comprising a temperature-indicating material, wherein the temperature-indicating material experiences a color change when exposed to a color-changing temperature.

14. The adhesive tape of claim 13, wherein the temperature-indicating material comprises a higher fatty acid ester; mercury iodide complexes of cholesterol; bianthrone; cyanine pigments; spirofuran-type compounds; triphenylmethane-type Ca and Mg salts; cobalt; nickel; iron; copper; chromium; manganese; lead; or a combination thereof.

15. The adhesive tape of claim 8, wherein said first adhesive layer comprises an acrylic type or rubber type adhesive.

16. The adhesive tape of claim 8, further comprising a second adhesive layer disposed on the film substrate opposite the first adhesive layer.

17. The adhesive tape of claim 8, wherein the film substrate has a multi-layered structure.

18. The adhesive tape of claim 8, further comprising a foam layer.

19. The adhesive tape of claim 8, further comprising a gripping tab attached to the first adhesive layer.

20. A method of removing the adhesive tape of claim 8 from a bonded article, said method comprising the steps of:

heating the adhesive tape to a temperature greater than the activation temperature; and

pulling the adhesive tape from the bonded article at an angle of up to 35° relative to a bonded surface on the bonded article.

21. A method of removing an adhesive tape from a bonded article, said method comprising the steps of:

heating the adhesive tape to a temperature greater than an activation temperature, said activation temperature ranging from about 25°C to about 100°C, said adhesive tape comprising a film substrate having (i) an elastic modulus of at least 7.0×10^8 Pa at a temperature below the activation temperature, (ii) an elastic modulus of not greater than 5.0×10^8 Pa at a temperature exceeding the activation temperature, and (iii) an elongation at break of at least 150% at a temperature exceeding the activation temperature; and

pulling the adhesive tape from the bonded article at an angle of up to 35° relative to a bonded surface on the bonded article.

22. The method of claim 21, wherein the adhesive tape further comprises a temperature-indicating material disposed within or on the film substrate, wherein the temperature-indicating material experiences a color change when exposed to a color-changing temperature, said method further comprising the step of:

monitoring the temperature-indicating material; and

if the temperature-indicating material changes color, performing said pulling step.